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Research Article

Predictors of Fatal Outcome after Incident of Stroke among Patients from Three Hospitals in Kinshasa, Democratic Republic of the Congo

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Summary

Objective: This study investigated the predictors of stroke fatal outcome after a one year follow-up. **Methods:** This was a historic cohort of 166 stroke patients from three hospitals in Kinshasa, capital of the Democratic Republic of Congo. Data were collected from patients as they were admitted. Vital outcome information was collected throughout the follow-up period. The Cox proportional hazard modeling was used to measure predictors. **Results:** The patients' median age was 59 (IQR: 52-68) years. The majority of them were male (65.1%) and known hypertensive (79.5%). Around 31% patients died within the one year period of follow-up; the median duration between the occurrence of stroke and death was 37 (14-155.5) days. The Glasgow Coma Score and day 7 blood glucose showed a significant influence on vital outcome: an early disorder of consciousness (Glasgow score <13) multiplies by 2.5 the risk of death (HR: 2.46, 95% CI [1.3-4.6], p = 0.005) and the glycaemia level at day 7 greater than or equal to 180 mg / dl increases the risk of death by 2.4 times (HR: 2.4, 95% CI [1.03 -5.7], p = 0.04). **Conclusion:** Hyperglycemia in the acute phase of stroke and early consciousness disorder are predictors of fatal prognosis of stroke, easy to detect in routine clinical practice. They should therefore be used to identify patients with potentially poor prognosis in the short and in the long term for appropriate care.

Keywords: Stroke prognostic factors; Hyperglycemia; Consciousness disorder; Democratic Republic of the Congo; Sub-Saharan Africa

Introduction

Stroke is the second leading cause of death worldwide. It accounts for 11.3 percent of all deaths each year of which 87% occur in low- and middle countries including the Democratic Republic of Congo (DRC). It's also the first cause of acquired disability in adults with an important burden since it affects the working age adults.

It is a pathology with high short-term mortality, despite progress in resuscitation [1, 2]. Much progress has been made in the knowledge of risk factors, well beyond traditional risk factors, thanks in particular to the performance of cardiovascular investigations, which has made it possible to considerably reduce the incidence of the disease, in particular in the developed countries [1-5]. On the other hand, much remains to be done with a view to reducing the mortality rate, which is still high, particularly in developing countries [1]. Efforts have focused in recent years on the development of various etiological treatment modalities, in particular thrombolysis [2, 6], but this track has shown its limits, particularly in low-income countries, due to the technical constraints that limit the epidemiological impact [7-9]. The track of knowledge of prognostic factors could represent an alternative for the reduction of mortality which still shows today a great disparity across different regions of the world [10].

Stroke prognostic factors

There are classically 2 types of explanatory variables of stroke prognosis:

Stroke-related features

- Clinical severity, assessable by various neurological scores (NIHSS, Glasgow, etc.);
- Size of the ischemic lesion or hematoma;
- Site of arterial occlusion;
- Etiology of stroke.

Patient-related characteristics: age, sex, degree of autonomy before the accident, anticoagulant treatment for hemorrhagic stroke, associated morbidities (history of stroke, diabetes, etc.).

Advanced age, male sex, comorbidities, in particular hyperglycaemia, are recognized by several studies as prognostic factors for stroke, mainly in the acute phase [11-18].

Several works in Sub-Saharan Africa (SSA) and especially in DR Congo which have looked at strokes have provided information on hospital morbidity and mortality and risk factors, mainly hypertension and diabetes. On the other hand, there is insufficient data on the prognostic factors of stroke, factors on which efforts to reduce mortality could be focused. It is within this framework of efforts to control prognostic factors that the present study is included, with the objective presented below.

Objective

To determine in a hospital population of 166 patients admitted for stroke the predictive factors of mortality after a one-year follow-up.

Methods

Type of study

This is a prospective and analytical study of 166 patients with stroke and recruited consecutively over a period of 3 months in 3 hospitals in Kinshasa, with a follow-up of one year.

Place of study

The work was carried out in three hospitals in the city of Kinshasa, in the Democratic Republic of Congo

Duration of the study

From December 10, 2012 to July 31, 2014. Patients were included from January 15 to April 15, 2013 and data collection covered the period from January 15, 2013 to April 15, 2014.

Inclusion criteria

Patients aged at least 18 years, admitted to hospitalization for stroke with diagnostic confirmation by brain scan.

Study size

This is an exhaustive study that recruited all patients hospitalized for stroke in the 3 hospitals concerned and during the study period. A total of 186 patients were recruited, including 166 included and 20 not included, distributed as follows: 12 cases of early death, before completion of the assessment, 4 cases of CT diagnosis other than stroke (tumors and cerebral abscess) and 4 cases with insufficient balance sheet.

Study parameters

In the anamnesis, we looked for the following parameters: age and sex, hypertension with regular treatment or not, diabetes with treatment or not, alcoholism, former or current smoking, history of TIA or stroke, history of coronary artery disease or obliterating arteriopathy of the lower limbs, use of oral contraceptives. Were considered to be hypertensive, patients known to be hypertensive with or without antihypertensive treatment or who presented a blood pressure ≥ 140/90 mmHg [19] on admission and who maintained it beyond the 1st week of hospitalization (beyond the acute phase of stroke). Diabetes mellitus was retained in

the presence of a known history of diabetes or by fasting blood sugar ≥ 126 mg/dl [20] on admission and beyond the first week of hospitalization. Alcoholism was defined as regular consumption greater than or equal to 2 glasses (10 g) of alcohol per day. Former smoking was defined as a cessation of tobacco consumption dating back more than a year.

During the clinical examination on admission: Blood pressure (BP) on admission and on day 7, taken from both arms using an electronic tensiometer; State of consciousness (Assessed using the Glasgow Scale) [21]; The early disorder of consciousness was defined by an alteration in the state of consciousness objectified on admission of the patient, with a Glasgow score of < 13; Nutritional status: Weight in kilograms, height in meters, abdominal circumference in centimeters, body mass index; Cardiac auscultation: regular or irregular rhythm; Auscultation of the carotids: presence or not of a murmur.

Cerebral imaging: Cerebral scanner for the diagnosis of the type of stroke and the description of the lesions.

Cardiovascular assessment

ECG: presence or absence of atrial fibrillation (AF), atrioventricular block, left ventricular hypertrophy (LVH) according to the Sokolow and Cornell indices or signs of old or recent infarction.

Cardiac echo-doppler (portable SONOSITE M-TURBO and SONOSITE TITAN devices): realization and interpretation according to the recommendations of the European Society of Echocardiography and the American Society of Echocardiography.

Echo-Doppler of the supra-aortic trunks: presence or not of a plaque, a stenosis or an occlusion.

Biology: Fasting blood glucose on admission and on day 7; the threshold value for hyperglycaemia in the acute phase used is 180 mg/dl, a value corresponding to the maximum physiological rate of renal glucose reabsorption [22,23]; Urea, Creatinine, Creatinine clearance according to the COCKROFT-GAULT formula [24], Total cholesterol, LDL-cholesterol, HDL-cholesterol, Triglycerides, White blood cells (WBC), Leukocyte formula (FL), Hemoglobin (Hb), Proteinuria . Renal failure was defined by a creatinine clearance value of less than 60 ml/minute [24]. Dyslipidaemia was defined by a total cholesterol value greater than 200 mg/dl or by an atherogenicity index (total cholesterol/HDL-cholesterol ratio) greater than 6.

Data collection and ethical aspect

The data was collected in a standardized way by 3 teams of agents each composed of a doctor and a finalist medical student previously prepared for this purpose. The teams were supervised by ourselves. All the cardiovascular echo-Doppler examinations were carried out by 2 cardiologist echocardiographers and the cerebral scanner by 2 radiologists. Data were collected from patients as they were admitted for 3 months, from January 15 to April 15, 2013, with the consent of the ethics committee of each institution. Informed consent was obtained from each patient.

As part of the follow-up, the data were collected from the period of hospitalization until 1 year after the last inclusion, i.e. April 15, 2014; Patient information was collected over the phone or, failing that, after a home visit.

Statistical analyzes

The data was analyzed by EXCEL, SPSS IBM version 20 and EPI INFO 3.5 software. The description of different parameters was made by calculating means and proportions. The probability of survival was evaluated by Kaplan-Meier survival curves and the Log Rank test was used to determine the variables having a significant influence on the vital outcome. In multivariate analysis, the Cox Model was used to determine the variables having a significant and independent influence on the vital outcome. The significance level was set at 5%.

Results

General population

A hospital population of 186 patients was initially recruited with a clinical diagnosis of stroke; 20 patients were not included for the following reasons: 12 patients died early, before the scan was performed, 4 patients presented a diagnosis other than stroke (tumors and cerebral abscess) on the scan, and 4 others were unable to perform the recommended assessment. These data are shown in Figure 1.

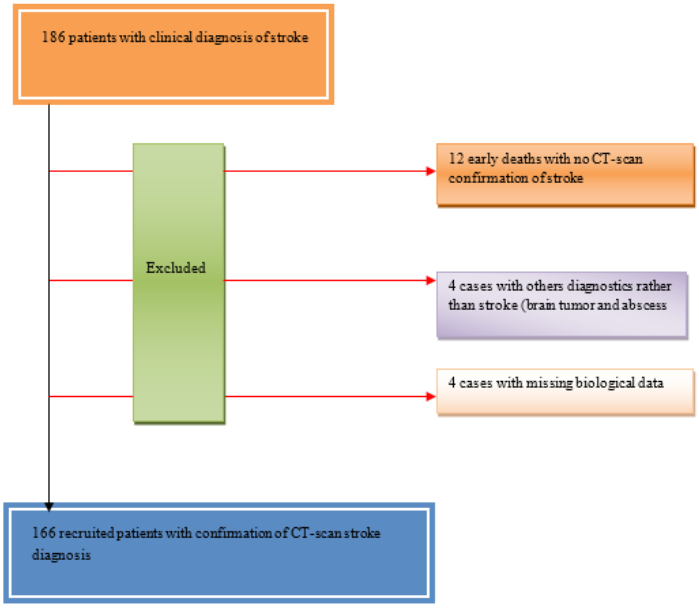

Figure 1: Flow chart of patients' recruitment to the study.

Demographic, clinical characteristics and cardiovascular and stroke risk factors

The demographic, clinical data and cardiovascular and stroke risk factors are presented in Table 1. Of all the patients included, 108 (65.1%) were male and 58 (34.9%) female, i.e. a sex ratio of 1.9. The average age is 59.6±12.3 years.

One hundred nine (65.7%) patients had an ischemic stroke and 57 (34.3%) a hemorrhagic stroke, an ischemia-hemorrhage ratio of 1.9 (Figure 2). More than a third of the patients (37.3%) presented a disorder of consciousness at all degrees, with an average Glasgow score of 12.3±2.5.

Hypertension is the most common cardiovascular risk factor. It was found in 140 (84.3%) patients, including 132 with a known history of hypertension. Of these 132 known hypertensive patients, 5 (4%) had regular treatment, 80 (58%) irregular treatment and 47 (36%) had no treatment. Diabetes was observed in 60 (36.1%) patients; 45 (27%) of them were known to have diabetes. Obesity was found in 28 (16.9%) patients.

Mean blood glucose value on admission was 113.4±44.8 mg/dl and increased to 151.5±90.33 mg/dl on day 7. Hypercholesterolemia was observed in almost half of patients (45.2%). Compared with hemorrhagic stroke, patients with ischemic stroke were older and more obese, had lower systolic and diastolic blood pressure, less impaired consciousness, and lower creatinine clearance.

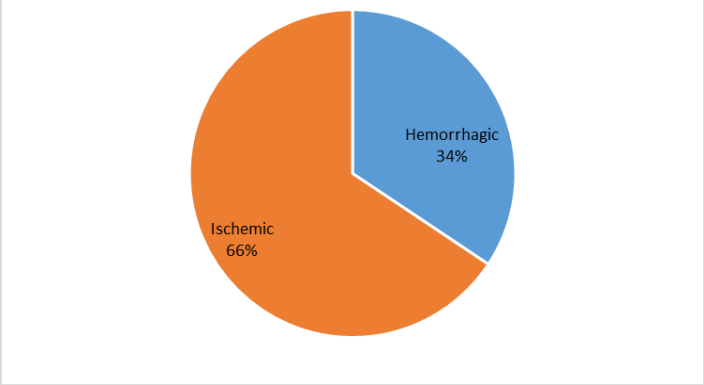

Figure 2: Type of stroke.

		Stroke		
	General population	**Ischemic**	**Hemorrhagic**	**P**
Demographic and anthropometric data	**n=166**	**n=109(65.7%)**	**n=57(34.3%)**	
Gender Male, n (%)	108(65.1)	74(67.9)	34(59.6)	0.3
Age, years	59.6±1..3	61.9±11.9	55.2±11.9	0.001
BMI, kg/m^2	28.2±15.3	27.3±7.0	29.9±24.4	0.3
Body area, m^2	1.88±0.2	1.90±0.2	1.88±0.2	0.86
Cardiovascular and stroke risk factors				
High blood cholesterolemia, n (%)	75(45.2)	51(46.8)	24(42.1)	0.56
Hypertension, n(%)	140(84.3)	91(83.5)	49(86)	0.68
Diabetes, n(%)	60(36.1)	44(40.4)	16(28.1)	0.117
Obesity, n (%)	28(16.9)	19(17.4)	9(15.8)	0.5
Harmful alcohol intake, n(%)	51(30.7)	33(30.3)	18(31.6)	0.86
Tabagism, n(%)	16(9.6)	10(9.2)	6(10.5)	0.78
Transient ischemic attack, n(%)	12(7.2)	12(11.0)	0	
Former stroke, n(%)	42(25.3)	31(28.4)	11(19.3)	0.19
Atrial fibrillation, n(%)	13(7.8)	11(10.1)	2(3.5)	0.13
Clinical data				
Systolic blood pression, mmHg	152.5±34.0	147.18±33.4	162.7±33.2	0.005
Diastolic blood pression, mmHg Heart rate, bpm Loss of consciousness (coma), n(%)	90.6±21.8 84.3±14.9 62(37.3)	88.10±22.7 84.2±15.8 33(30.3)	95.53±19.4 84.5±15.8 29(50.9)	0.03 0.90 0.01
Biologic data				
Glycaemia intake, mg/dl	151.5±90.4	154.6±95.8	145.3±78.9	0.53
Glycaemia intake ≥126 mg/dl, n(%)	71(42.8)	47(43.1)	24(42.9)	0.97
Glycaemia 7th day, mg/dl	113.4±44.9	114.3±44.8	111.73±45.2	0.73
Glycaemia 7th day ≥126 mg/dl, n(%)	38(23)	27(24.8)	11(19.3)	0.45
Urea (mg/dl)	44.4±33.9	45.6±36.9	42.1±27.1	0.52
Creatinine, mg/l	13.0±9.5	14.0±10.8	11.2±5.8	0.02
Creatinine clearance, ml /min	82.9±42.3	75.6±37.9	96.9±46.6	0.01
Creatinine clearance <60ml/min, n(%)	52(31.3)	38(34.9)	14(24.6)	0.17
Total cholesterol, mg/dl	192.11±36.4	189.1±61.7	198.2±51.7	0.34
LDL cholesterol, mg /dl	125.5±41.5	124.2±61.7	128.2±43.7	0.56
HDL cholesterol, mg/dl	51.8±42.7	53.8±44.7	47.7±17.8	0.49
Triglycerides, mg/dl	108.1±49.9	104.8±44.2	114.8±59.2	0.22
Hemoglobin, mg/dl	13.2±4.8	13.3±5.8	12.8±2.2	0.56
White blood cells, /mm3	8514±4255	8174±4366	9166±3991	0.15

BMI: Body Mass Index.

Table 1: Demographic, clinical and biological data.

Echocardiographic data

Left atrial dilation was found in 31 (18.7%) patients, left ventricular hypertrophy in 107 (64.5%) and left ventricular dysfunction in 13 (7.8%) (Table 2).

Parameters	*n*	*%*
Left atrium		
-area≥20 cm^2	31	18.7
-area<20 cm^2	135	81.3
Left ventricular mass		
->115 g/m^2	107	64.5
-≤115 g/m^2	59	35.5
Systolic function of the left ventricle		
-FEVG<55%	13	7.8
-FEVG≥55%	153	92.2

Table 2: Echocardiographic data.

Mortality, Survival Analysis and Predictive Factors

Mortality

Thirty-two patients died during hospitalization, representing an in-hospital mortality rate of 19.3%. The cumulative mortality rate at 1 year was 30.7%.

Survival Analysis and Predictive Factors

Univariate analysis

In univariate analysis, the following variables were analysed: age (>60 years), sex, Glasgow score< 13, hypertension-diabetes association, history of AIT or stroke, atrial fibrillation, left atrium dilation, left ventricular dilation, dysfunction left ventricular systolic, left ventricular hypertrophy, blood glucose on day 7 ≥180 mg/dl, total cholesterol> 200 mg/dl, white blood cells ≥ 10000/ mm3, creatinine clearance< 60 ml/minute and proteinuria. Of all these variables, only the Glasgow Coma Score and day 7 blood glucose showed a significant influence on vital outcome as shown by the Kaplan-Meier survival curves in Figures 3 and 4.

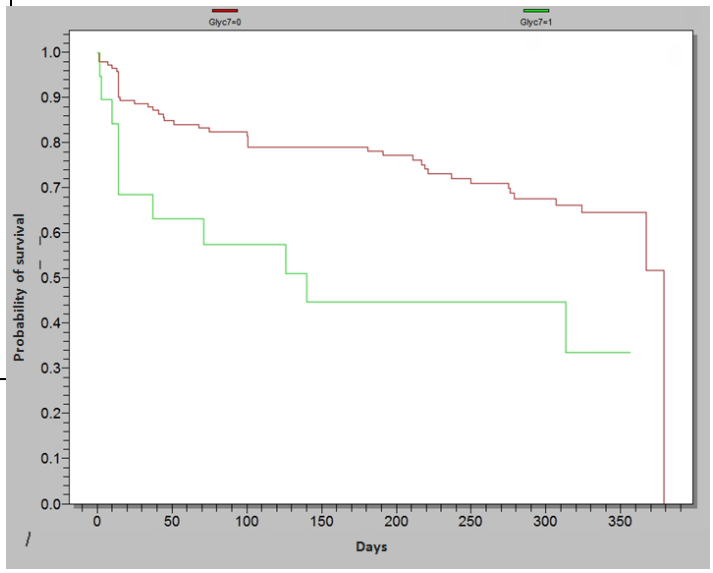

Figure 3: Comparison of survival curves according to blood glucose on day 7.

"Glycaemia7=0" = Day 7 blood sugar<180mg/dl (curve in red); "Glycaemia7=1" = Glycaemia on day 7≥180mg/dl (curve in green). The probability of survival was lower in patients with a blood sugar level greater than or equal to 180 mg/dl (log Rank test =8,1, p=0,004).

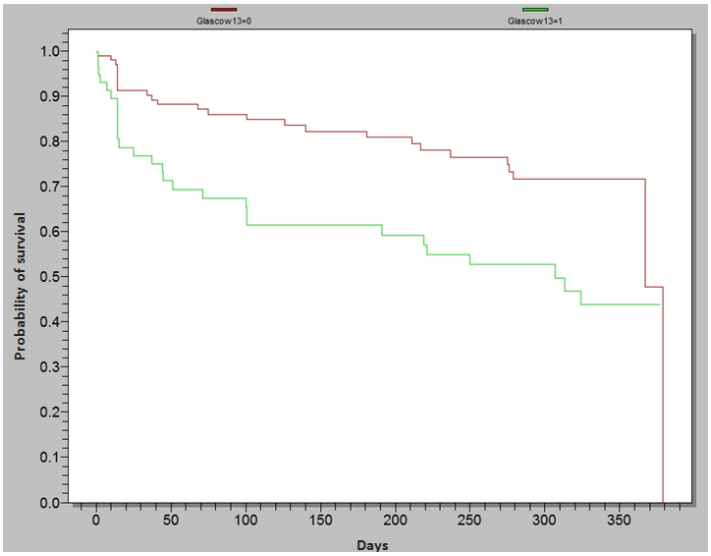

Figure 4: Comparison of survival curves according to the Glasgow score.

"Glasgow13=0" = Glasgow ≥13 (curve in red); "Glasgow13=1" = Glasgow <13 (curve in green). Patients with a Glasgow score lower than 13 had a shorter survival than those with a score greater than or equal to 13 (225,6 ± 21,8 days against 302,8 ± 13,7 days; Log Rank test = 9,5; p=0,002).

Multivariate analysis (Cox model)

In multivariate analysis, the same predictors of mortality were found:

1. An early disorder of consciousness (Glasgow score<13): multiplies the risk of death by 2,5 (HR: 2,46; 95% CI [1,3 -4,6]; p=0,005),
2. Blood sugar on day 7 greater than or equal to 180 mg/dl: multiplies the risk of death by 2,4 (HR: 2,4; 95% CI [1,03 -5,7]; p=0,04) (Table 3)

Factors	HR	IC95% (BI)	IC95% (BS)	Coefficient	S. E.	Z-Statistique	Valeur-P
1. Age < 60 years old	1						
60 years and over	0.9852	0.5234	1.8545	-0.0149	0.3227	-0.0461	0.9632
2. History of stroke	1						
No							
Yes	0.9805	0.5104	1.8838	-0.0197	0.3331	-0.059	0.9529
3. Total cholesterol	1						
≤ 200 mg/dl							
> 200 mg/dl	1.24	0.6951	2.212	0.2151	0.2953	0.7284	0.4663
4. Créatinine clearance	1						
≥60 mg/dl							
< 60 mg/dl	1.1677	0.6165	2.2119	0.1551	0.3259	0.4758	0.6342
5. Diabetes HBP comorbidity	1						
No							
Yes	1.0388	0.4851	2.2246	0.0381	0.3885	0.0979	0.922
6. LV systolic fonction	1						
Normal							
Altered	0.7456	0.2161	2.573	-0.2936	0.632	-0.4645	0.6423
7. WBC	1						
< 10000/mm^3							
8. Glasgow	1						
≥ 13							
< 13	2.4612	1.3212	4.5849	0.9007	0.3174	2.8376	0.0045
9. Glycaemia on D7	1						
<180 mg/dl							
	2.4181	1.0338	5.6564	0.883	0.4336	2.0365	0.0417
≥ 180 mg/dl							
10. Left ventricular mass	1						
< 116 g/m^2							
≥ 116 g/m^2	0.8273	0.448	1.5277	-0.1896	0.313	-0.606	0.5445
11. Left atrium	1						
Normal							
Dilated	1.6296	0.7198	3.6895	0.4884	0.4169	1.1713	0.2415
12. Sex	1						
Female							
Male	0.8116	0.4497	1.465	-0.2087	0.3013	-0.6926	0.4885
13 .Type of stroke	1						
Hemorrhagic							
Ischemic	1.3431	0.6856	2.6311	0.295	0.3431	0.8598	0.3899
HBP=high blood pression; LV=left ventricle; WBC= white blood cells; D=day.							

Table 3: Predictors of mortality (Cox model).

The independent predictors of mortality are:

1. An early disorder of consciousness (Glasgow score<13): multiplies the risk of death by 2.5 (HR: 2.46; 95% CI [1.3 -4.6]; p=0.005).
2. Glycaecia on day 7 greater than or equal to 180 mg/dl: multiplies the risk of death by 2.4 (HR: 2.4; 95% CI [1.03 -5.7]; p=0.04).

Discussion

The present study identified 2 prognostic factors having an independent and significant influence on the vital outcome at 1 year post-stroke. These are hyperglycemia in the acute phase of stroke and impaired consciousness on admission.

This result is in line with most studies on the prognosis of stroke. However, it is important to highlight a few observations regarding each of these prognostic factors.

With regard to hyperglycaemia, 2 observations are worth mentioning: firstly, most of the studies consulted during this work have focused either on the acute phase of stroke, sometimes with an extension over 60 to 90 days (12, 18, 25-29), either on the short and/or the long term (12, 14, 16, 27, 28). In the 1st category, hyperglycemia has been identified as a prognostic factor in the acute or short-term phase of stroke. This study reinforces the idea that hyperglycemia plays a major prognostic role in both the short and long term of stroke. Secondly, the glycemic threshold considered is not identical in the different studies. It varies from 126 mg/dl to 180 mg/dl, passing through 140 mg/dl. Despite these threshold differences, all of these studies came to the same conclusion on the adverse prognostic role of hyperglycemia. In the absence of a precise prognostic threshold criterion, the present study was based on a physiological basis, taking as reference the level of 180 mg/dl which classically corresponds to the renal glucose absorption threshold.

As for the mechanism by which hyperglycemia affects the vital prognosis, this would go through an increased secretion of HMGB1, a pro-inflammatory nuclear protein responsible for brain damage and lesions on the blood-brain barrier [30]. The administration of a specific inhibitor of HMGB1, glycyrrhizin, in an animal model, has been shown to attenuate brain damage and lesions on the blood-brain barrier by decreasing the degradation of tight junction proteins, which represents a potential therapeutic option to be explored in hyperglycaemia in the acute phase of cerebral infarction [30]. In addition, other experimental and clinical studies have shown that hyperglycemia would also act by exacerbating calcium imbalance, the production of energy by anaerobic route which leads to an accumulation of lactic acid, by reducing cerebral perfusion by lowering the availability of nitric oxide and finally by intensifying the inflammatory response [31].

Finally, note that in the multivariate analysis, after separating the patients into 2 groups, ischemic stroke and hemorrhagic stroke, hyperglycaemia only appeared as a significant prognostic factor in the ischemic stroke group; in the literature consulted, it concerned both ischemic stroke [11,12,26,28,32-34] and hemorrhagic stroke [27,29,35]. It is possible that the reduced number of cases of hemorrhagic stroke helped to mask the true effect of hyperglycemia.

With regard to impaired consciousness, the present study is in perfect agreement with all the studies consulted which have formally recognized it as a marker of stroke severity and a major short- and long-term prognostic factor, using, in the assessment of the state of consciousness, either the NIHSS score (National Institute of Health Stroke Score), or the Glasgow score [15,26,36-43]. Early impaired consciousness emerged as an independent predictor of 1-year mortality both in all patients and in each type of stroke. The power of this marker is related to the fact that it is directly related to the extent of the ischemic injury or hematoma, as can be appreciated by diffusion MRI or CT scan.

The hospital mortality rate (19.3%) and the cumulative mortality rate at 1 year (30.7%) are lower or at most in the same proportions as those described elsewhere in Africa and do not deviate too much from those of most Western studies consulted [1,12-14,44-48]. Subject to methodological aspects, this could reflect a certain trend towards a reduction in the discrepancy in stroke management between regions.

Alongside prognostic factors, it is worth noting certain observations relating to the general characteristics presented by the patients on admission. These are mainly the type of stroke, age and hypertension. The ischemic stroke-hemorrhagic stroke ratio is very well known in high-income countries and is 4/1, i.e., 80% for ischemic stroke and 20% for hemorrhagic stroke.

This ratio is not very well known in low-income countries, mainly due to the lack of large-scale clinical or epidemiological studies. Nevertheless, most of the studies that exist have indicated, for these countries in a situation of epidemiological transition, a higher proportion of hemorrhagic stroke than in the West, placing it between 30 and 60% [1, 47, 48], and closer to Asian data, mainly those from Japan [45].

The present study partially confirmed this trend in developing countries with a ratio of 65.7% for ischemic stroke and 34,3% for hemorrhagic stroke, i.e., a ratio of 1,9. This can be explained by several reasons, including under diagnosis of hypertension and poor control for screened patients. Several studies have shown that in Africa more than 40% of hypertensive are undiagnosed, less than 30% of those diagnosed are treated and less than 20% of those treated are controlled [46-49], which increases the risk

of complications, including hemorrhagic stroke, hypertension being directly related to hemorrhagic stroke. The same trend has been observed in certain socially disadvantaged communities in the United States of America where the morbidity and mortality linked to strokes and other cardiovascular diseases was higher than in the rest of the population [49]. Furthermore, it is possible that this proportion of hemorrhagic strokes was underestimated, in particular because of the early deaths that occur in this type of stroke, many of which before the scan is performed, or sometimes even before arrival at the hospital, thus making a selection in favor of ischemic strokes.

However, the evolution of the populations of these regions towards more modern lifestyles should be taken into account in the evolution of the ischemia/hemorrhage ratio. The average age of onset of the disease (58 ± 11 years) is remarkably lower than in the West. This notable difference with the West could be partly explained by a lack of management of cardiovascular risk factors and by the overall low life expectancy in Africa.

Hypertension is by far the most frequently encountered risk factor, an observation consistent with data from the literature. Moreover, according to the study "The INTERSTROKE study" which covered 22 countries from all continents, hypertension appeared to be a major risk factor whatever the region [50] and whatever the stage [51]. It acts either indirectly through atherosclerosis, or directly in favor of acute attacks, thus usually causing in this case a cerebral or cerebro-meningeal hemorrhage. Hypertensive attacks are most often observed in untreated or insufficiently treated hypertension. This lack of hypertension control could explain the high prevalence of hemorrhagic stroke in Africa.

Limitations of the Study

The choice of establishments, dictated by the imperative of feasibility of the examinations, had the disadvantage of a certain selectivity of the study population. Indeed, the three establishments concerned by the study are generally not accessible to the majority of the population; therefore, the study population probably does not include all the social strata of the general population in their socio-cultural diversity and standard of living, diversity implying differences in the prevalence of risk factors. A truly multicenter study including establishments with large public attendance could have the advantage of a minimum of representativeness with the effect of reducing the information bias.

The short duration of the study resulted in a relatively small number and therefore low power. Performing the brain scan at different times during hospitalization (some patients do not immediately meet the fees required for the examination), may have created a selection of cases to the detriment of more serious cases who die early. Finally, the absence of contact markers in the files of certain patients made it difficult to follow up on these patients, which contributed to increasing the number of people lost to follow-up. However, this study will have allowed us to have local information on strokes that could be expanded later.

Conclusion

The results obtained in this study lead to the following observations:

1. Hyperglycemia in the acute phase of stroke is an independent predictor of not only short-term but also long-term stroke mortality.
2. Early consciousness disorder is also a predictor of short and long-term mortality, regardless of the level of the disorder.
3. These 2 parameters, both severity markers and prognostic factors of stroke, easily detected in current clinical practice, should be used to identify patients with potentially poor short- and long-term prognosis with a view to taking more forceful and appropriate charge.

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